

CLAIMS

1. A biosensor comprising

5 - a transparent sensor chip,

- a sensing area for interaction between a provided multitude of light rays with a range of angles of incidence to said sensing area and a substance, the interaction between the provided multitude of light rays and the substance defining at least part of a response of

10 the biosensor, and

- a part of the biosensor comprising at least one dispersion compensating element being adapted to, at least substantially independently of the effective refractive index of said substance within a predetermined effective refractive index range, compensate the

15 dispersion induced in the biosensor by other parts of the biosensor,

so as to obtain a response of the biosensor being essentially independent of the wavelength of the multitude of light rays interacting with the substance.

20 2. A biosensor according to claim 1, said biosensor defining an image plane, wherein the multitude of light rays are imaged onto the image plane in such a way that for any light ray r_i belonging to the multitude of light rays having a wavelength λ_i and angle of incidence θ_i , said light ray r_i exhibiting subpart R_i of the response of the biosensor and being imaged onto the image plane at a position P_i , the dispersion compensating element

25 is adapted to ensure that any light ray r_k belonging to the multitude of light rays having a wavelength λ_k and an angle of incidence θ_k , said light ray r_k exhibiting a subpart of a response of the biosensor corresponding to R_i is imaged onto the image plane at essentially the same position P_i .

30 3. A biosensor according to claim 1, further comprising a detector array.

4. A biosensor according to claim 3, further being adapted to yield minimum dispersion of the response of the biosensor by adjusting the distance between the transparent sensor chip and the detector array.

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5. A biosensor according to claim 3, further being adapted to yield minimum dispersion of the response of the biosensor by adjusting an angle between a direction defined by a mean propagation vector of the incoming light rays and a plane defined by the detector array.
- 5 6. A biosensor according to claim 1, wherein the response of the biosensor is a surface plasmon resonance response.
7. A biosensor according to claim 1, wherein the transparent sensor chip is solid.
- 10 8. A biosensor according to claim 1, wherein the other parts of the biosensor comprise one or more conducting films being arranged on an exterior surface part of the transparent sensor chip, and forming part of the sensing area.
9. A biosensor according to claim 8, wherein the one or more conducting films are
- 15 arranged in a multilayer system of conducting films.
10. A biosensor according to claim 8, wherein the one or more conducting films comprise metal layers of a material selected from the group consisting of aluminium, gold, silver or the like.
- 20 11. A biosensor according to claim 1, wherein the other parts of the biosensor comprise a multilayer of dielectric materials forming a resonant mirror being arranged on an exterior surface part of the transparent sensor chip, and forming part of the sensing area.
- 25 12. A biosensor according to claims 1, further comprising
- a first and a second diffractive optical element forming part of a surface of the transparent sensor chip, the diffractive optical elements each comprising a grating structure.
- 30 13. A biosensor according to claim 12, wherein at least one of the dispersion compensating element(s) forms part of at least one of the diffractive optical elements.
14. A biosensor according to claim 13, wherein the dispersion compensating element(s)
- 35 forming part of at least one of the diffractive optical elements is further adapted to compensate the dispersion induced by said diffractive optical element.
15. A biosensor according to claim 12, wherein the grating structures form a transmission grating structure.

16. A biosensor according to claim 12, wherein the grating structures form a reflection grating structure.
- 5 17. A biosensor according to claim 12, wherein the first diffractive optical element is adapted to focus or diverge an incoming light ray.
18. A biosensor according to claim 12, wherein the second diffractive optical element is adapted to collimate a diverging light ray.
- 10 19. A biosensor according to claim 12, wherein the diffractive optical elements further comprises one or more calibration marks, said one or more calibration marks being areas with missing grating structures.
- 15 20. A biosensor according to claim 12, wherein the multitude of light rays are incident at least substantially normal to a plane defined by the first diffractive optical element.
21. A biosensor according to claim 1, wherein at least the dispersion compensating element has been provided by performing the following steps:
- 20 - providing a master substrate having a substantially plane surface,
- providing a photosensitive layer of material onto the substantially plane surface of the master substrate,
- 25 - providing a first surface relief pattern by exposing the photosensitive layer to a first and a second wave of electromagnetic radiation so as to expose the photosensitive layer to a first interference pattern generated by a spatial overlap at an intersection between the first wave of electromagnetic radiation having a first focussed area and the second wave of
- 30 electromagnetic radiation having a second focussed area,
- providing a second surface relief pattern by exposing the photosensitive layer to a third and a fourth wave of electromagnetic radiation so as to expose the photosensitive layer to a second interference pattern generated by a spatial overlap at an intersection between
- 35 the third wave of electromagnetic radiation having a third focussed area and the fourth wave of electromagnetic radiation having a fourth focussed area,
- wherein the positions of the first, second, third, and fourth focussed areas are selected in such a way that the first and second diffractive optical elements replicated from the

surface relief patterns compensate for dispersion induced by other parts of the optical sensor.

22. A method of forming surface relief patterns adapted to be replicated onto a substantially plane surface of a member to form a first and a second diffractive optical element, the substantially plane member forming part of an optical sensor, the method comprising the steps of

- providing a master substrate having a substantially plane surface,
 - providing a photosensitive layer of material onto the substantially plane surface of the master substrate,
 - providing a first surface relief pattern by exposing the photosensitive layer to a first and a second wave of electromagnetic radiation so as to expose the photosensitive layer to a first interference pattern generated by a spatial overlap at an intersection between the first wave of electromagnetic radiation having a first focussed area and the second wave of electromagnetic radiation having a second focussed area,
 - providing a second surface relief pattern by exposing the photosensitive layer to a third and a fourth wave of electromagnetic radiation so as to expose the photosensitive layer to a second interference pattern generated by a spatial overlap at an intersection between the third wave of electromagnetic radiation having a third focussed area and the fourth wave of electromagnetic radiation having a fourth focussed area,
- wherein the positions of the first, second, third, and fourth focussed areas are selected in such a way that the first and second diffractive optical elements replicated from the surface relief patterns compensate, at least substantially independently of the effective refractive index of said substance within a predetermined effective refractive index range, for dispersion induced by other parts of the optical sensor.

23. A method according to claim 22, wherein the master substrate is rotated approximately 180 degrees after the providing of the first surface relief pattern and prior to the providing of the second surface relief pattern.

24. A method according to claim 22, wherein the first, second, third and fourth waves of electromagnetic radiation have substantially the same wavelength.

25. A method according to claim 24, wherein the first, second, third and fourth waves of electromagnetic radiation originate from the same light source.
26. A method according to claim 25, wherein the same light source comprises a laser, such
5 as a HeCd laser, a Kr-laser, an excimer laser, or a semiconductor laser.
27. A method according to claim 22, further comprising the step of developing the photosensitive layer.
- 10 28. A method according to claim 22, wherein the first wave of electromagnetic radiation forms an object wave, and wherein the second wave of electromagnetic radiation forms a reference wave.
29. A method according to claim 22, wherein the master substrate is constituted by a
15 substantially transparent member.
30. A method according to claim 29, further comprising the step of performing a sacrificial-layer-etch of the photosensitive layer in order to replicate the first and second surface relief patterns into the substantially plane surface of a substantially transparent member.
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31. A method according to claim 30, wherein said step of performing a sacrificial-layer-etch of the photosensitive layer is achieved by means of ion-milling, chemically assisted ion-beam etching or reactive ion etching.
- 25 32. A method according to claim 22, further comprising the step of forming a negative metal master of the first and second surface relief patterns for further replication of said first and second surface relief patterns.
33. A method according to claim 32, wherein the metal master is a nickel master.
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34. A method according to claim 32, further comprising the step of replicating, in a substantially transparent sensor chip, the first and second surface relief patterns from the negative metal master using hot embossing.
- 35 35. A method according to claim 32, further comprising the step of replicating, in a substantially transparent sensor chip, the first and second surface relief patterns from the negative metal master using injection moulding.

36. A method according to claim 32, further comprising the step of replicating, in a substantially transparent sensor chip, the first and second surface relief patterns from the negative metal master using injection compression moulding.

5 37. A method according to claim 34, further comprising the step of providing a metal layer on top of the replicated first and second surface relief patterns.

38. A method according to claim 37, wherein the metal layer is provided by means of thermal evaporation, e-beam evaporation or sputtering.

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39. A method according to claim 37, wherein the provided metal layer comprises a material selected from the group consisting of aluminium, gold, silver or the like.